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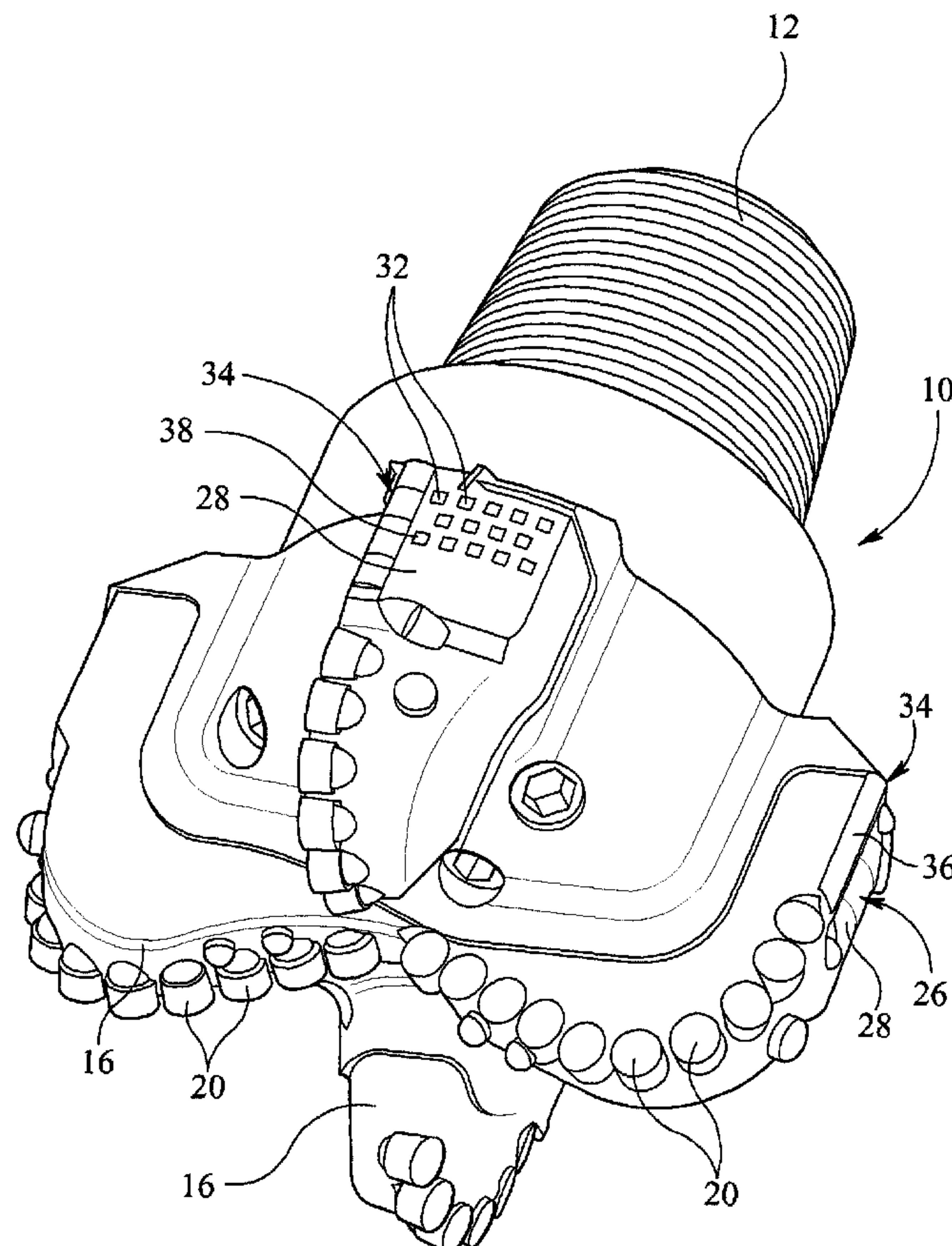
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(54) **Titre : OUTIL DE FORAGE ROTATIF**

(54) **Title: ROTARY DRILL BIT**



(57) **Abrégé/Abstract:**

A drill bit comprises a bit body including a gauge region of discontinuous form, a wear reducing arrangement applied to at least part of the gauge region, and a guard arrangement protecting at least part of a leading edge of the wear reducing arrangement, the guard arrangement comprising an element of tungsten carbide secured to the gauge region.

ABSTRACT

- 5 A drill bit comprises a bit body including a gauge region of discontinuous form, a wear reducing arrangement applied to at least part of the gauge region, and a guard arrangement protecting at least part of a leading edge of the wear reducing arrangement, the guard arrangement comprising an element of tungsten carbide secured to the gauge region.

Rotary Drill Bit

This invention relates to a drill bit, and in particular to an earth boring rotary drill bit for use in the formation of boreholes, for example for subsequent use in the extraction of oil and/or natural gas. The invention relates, in particular, to a drill bit
5 having a gauge region provided with an abrasion resistant gauge surface.

One common form of rotary drill bit is shown in Figure 1 and comprises a bit body having a plurality of blades formed integrally therewith. Each blade is provided
10 with a series of cutting elements which, in use, scrape, abrade or otherwise remove formation material upon rotation of the drill bit whilst a weight on bit loading is applied thereto. A range of cutting elements are known, one common form of cutting element comprising a substrate of, for example, tungsten carbide to which a layer of polycrystalline diamond is integrally mounted. The cutting elements are,
15 for example, brazed or shrink fitted to the bit body.

The bit body includes a gauge region which bears, in use, against the wall of the hole drilled by the drill bit. The bit body is typically formed of a relatively soft material, for example steel, and it will be appreciated that the gauge region is
20 subject to significant levels of wear, for example resulting from abrasion as the surface of the gauge region engages and rubs against the wall. As replacing a drill bit involves halting the drilling process for a considerable period of time, it is desirable to protect the drill bit against such wear, thereby reducing the regularity with which the drill bit requires replacement. It is known to provide the gauge

surface with a wear resistant arrangement in order to control wear of the gauge region and thereby extend the working life of the drill bit. For example, a series of tungsten carbide inserts or blocks and a hardfacing material layer may be provided upon the gauge region to enhance the wear resistance thereof. Alternatively, 5 elements including, for example, a surface of polycrystalline diamond may be mounted upon the bit body with the polycrystalline diamond surface arranged to bear against the wall of the hole, in use. A further alternative is to mount rollers on the gauge region. However, a number of other wear reducing techniques are known.

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Although such techniques serve to reduce wear of the gauge region, it has been found that, after having been used for some time, there is a tendency for the wear reducing material to separate from the gauge region, thereby reducing its wear reducing properties, or even causing damage to the drill bit. For example, where a 15 hard facing material layer is used, there is a tendency for the layer to peel away from the gauge region. This effect is particularly apparent on bits of the type in which the gauge region is not continuous around the entire bit body, but rather is of segmental form. Obviously, such separation is undesirable.

20 It is an object of the invention to provide a drill bit in which the disadvantages described hereinbefore are overcome or are of reduced effect.

According to the present invention there is provided a drill bit comprising a bit body including a gauge region of discontinuous form, a wear reducing arrangement

applied to at least part of the gauge region, and a guard arrangement protecting at least part of a leading edge, in the direction of rotation of the drill bit, in use, of the wear reducing arrangement, the guard arrangement comprising an element of tungsten carbide secured to the gauge region.

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The element of tungsten carbide is preferably of generally cylindrical form, and is preferably arranged such that its axis extends substantially parallel to the axis of rotation of the drill bit.

- 10 Such an arrangement is advantageous in that the leading edge of the wear reducing arrangement is protected from at least some abrasion and impact damage, thereby reducing the risk of damage and separation thereof from the bit body.

- The element is preferably of multi-part form, for example comprising a plurality of
15 cylindrical components stacked one upon another. The use of a plurality of components in this manner is advantageous in that if an individual component is damaged, the risk of cracks propagating along the element to an adjacent component is reduced.

- 20 The cylindrical components may have polycrystalline diamond layers formed thereon, for example comprising used or reject cutters unsuitable for use as cutting elements on the drill bit.

The bit body is preferably formed with a locating groove in which the element is mounted. The locating groove may be designed such that the element, or individual components thereof, where appropriate, are inserted therein from an end of the groove, and held captive by the groove. However, this need not be the case and the invention is also applicable to arrangements in which the element is secured in other ways, for example it is currently envisaged that the elements will be brazed in position on the bit body. Of course, these securing techniques may be used in combination.

The invention will further be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a view illustrating, diagrammatically, a known, prior art form of drill bit;

Figure 2 is a view similar to Figure 1 but illustrating a drill bit in accordance with one embodiment of the invention; and

Figure 3 is an enlarged, diagrammatic view illustrating part of the guard element of the bit illustrated in Figure 2.

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Referring firstly to Figure 1 there is illustrated a drill bit comprising a bit body 10 of cast steel form. Although the body 10 is of cast form, the invention is also applicable to matrix bodied bits. The bit body 10 includes a mounting region 12 whereby it can be secured to a drill string for rotation about an axis of rotation 14.

The bit body includes a series of upstanding integral blades 16, each of which includes a leading edge 18 provided with a series of cutting elements 20. The cutting elements 20 each comprise a substrate 22 of tungsten carbide to which is bonded a layer of polycrystalline diamond 24. In the arrangement illustrated, the cutting elements 20 are each of substantially cylindrical form, but this need not be the case and arrangements are known in which the cutting elements have, for example, domed or other shaped working surfaces. The cutting elements 20 are brazed, shrink fitted or otherwise secured in position on the bit body 10.

The bit body 10 further includes a gauge region 26 defining a gauge surface 28 of generally cylindrical outer periphery, but of discontinuous form, being interrupted to defined flow channels 30 through which drilling fluid delivered from nozzles 17 in the blades 16 can flow to carrying cuttings, etc, away from the blades 16 and cutting elements 20. The gauge surface 28 is provided with a wear reducing arrangement in the form of a plurality of blocks 32 tungsten carbide secured to the gauge region 26 and overlaid with a layer of a hard facing material. Although the use of a plurality of blocks 32 is illustrated, a number of other wear reducing techniques are also known for enhancing the wear or abrasion resistance of the gauge surface 28, for example as described in EP 1036913.

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In use, the drill bit is rotated about the axis 14 and a weight on bit loading is applied to the bit, with the result that the cutting elements 20 bear against the formation material being drilled, scraping, abrading or otherwise removing material therefrom, and thus extending the length of the hole drilled using the bit. The drilling fluid

supplied to the nozzles 17 serves to clean and cool the cutting elements 20, washing the material through the flow channels 30 and away from the drill bit.

Abrasion and/or impact damage to the hard facing material can result in it peeling away of otherwise becoming separated, exposing the blocks 32 which in turn will wear at an increased rate, possibly also becoming dislodged or separating from the gauge region 26. It will be appreciated that these effects give rise to a reduction in the wear reducing capability of the wear reducing arrangement, and as a result, the gauge region 26 may be subject to increased, undesirable levels of wear, and the working life of the drill bit may be shortened.

Figure 2 illustrates a drill bit similar to that illustrated in Figure 1 but modified, in accordance with the invention, to include a series of guard arrangements 34. In other respects, the drill bit of Figure 2 is substantially the same as that shown in Figure 1 and so a further description of those parts of the drill bit is not included herein, and like reference numerals are used hereinafter to refer to parts equivalent to those described hereinbefore.

Each guard arrangement 34 comprises an element 36 of tungsten carbide which is secured to the gauge region 26 at a position ahead of a leading edge 38 of the wear reducing arrangement, in the direction of rotation of the drill bit, to protect the wear reducing arrangement from at least some wear and/or impact damage, thereby reducing the risk of peeling of the hard facing material thereof, or wear or damage to the blocks 32 or other components of the wear reducing arrangement causing

lifting or separation thereof from the gauge region 26, and thus reducing wear and extending the working life of the drill bit.

As can be seen in Figure 3, the element 36 is of generally cylindrical form having a longitudinal axis 40 extending substantially parallel to the axis of rotation 14 of the drill bit, and arranged so that the part thereof most remote from the axis of rotation 14 of the drill bit lies at substantially the same diameter as the gauge diameter of the bit. Conveniently, the element 36 is of substantially circular cross-sectional shape, as this may result in manufacturing advantages or simplifications, but this need not always be the case. The element 36 is, in this arrangement, of multi-part form, being made up of a series of individual components 42. One advantage of such an arrangement is that the propagation of damage along the element 36 is reduced compared to arrangements in which the element 36 is of one piece form. As a result, damage to part of the element 36 is less likely to result in total failure of the element, but rather parts thereof will continue to function adequately despite such damage having occurred.

As illustrated, it is envisaged that one or more of the components 42 may comprise a cutter 44 including a substrate 46 of tungsten carbide to which a layer 48 of polycrystalline diamond is bonded. For example, cutters which have been rejected as unsuitable for use in performing a cutting function may be used. Alternatively, used or worn cutters could be used. It will be appreciated that the cutters 44 used in the element 36 do not perform a cutting function, their orientation and positioning on the drill bit being such that substantially no cutting is undertaken thereby, in use.

However, although cutters 44 are illustrated as being used in the element 36, it will be appreciated that this need not be the case, and that the element 36 could be formed of a series of discs of tungsten carbide or the like.

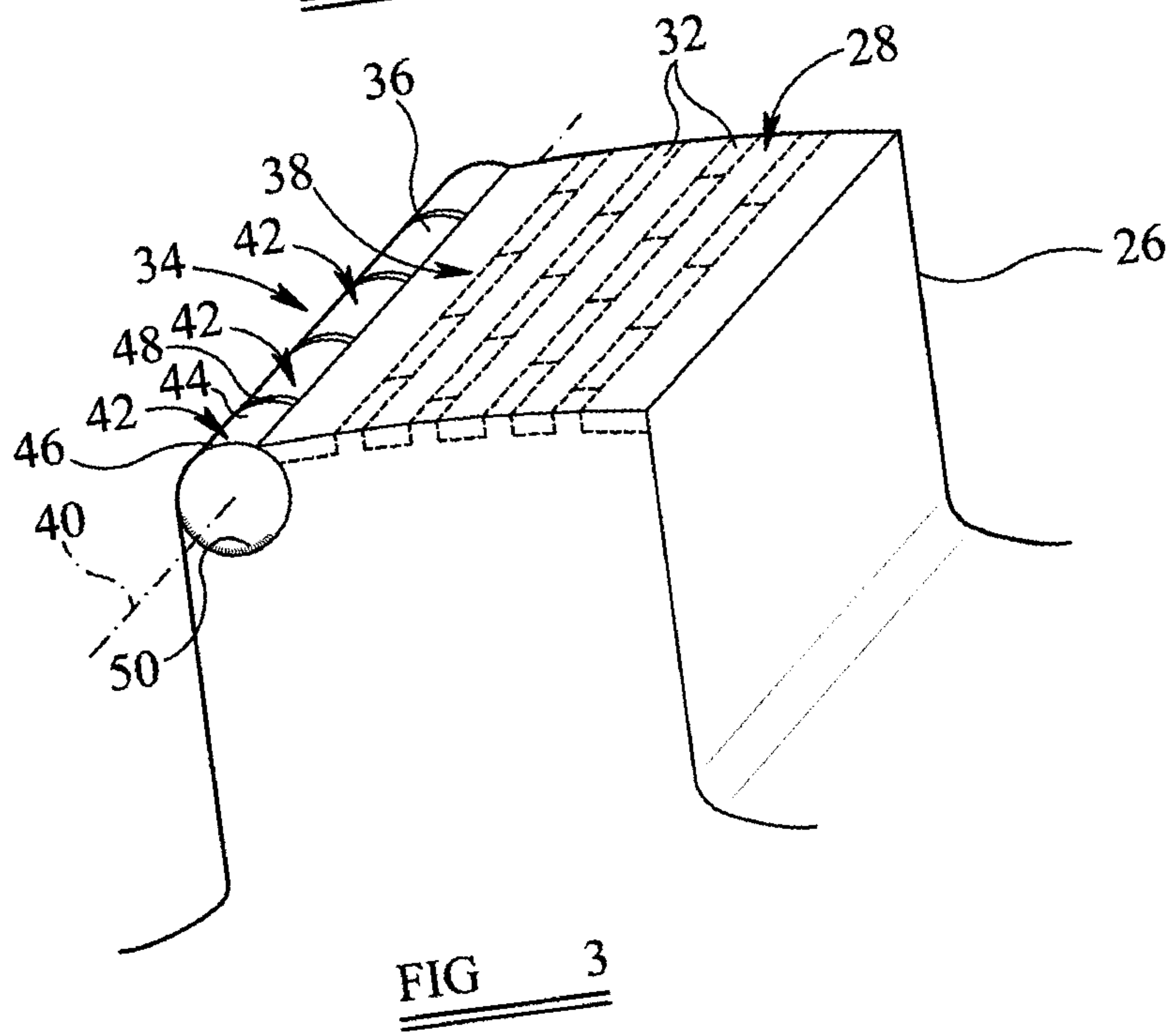
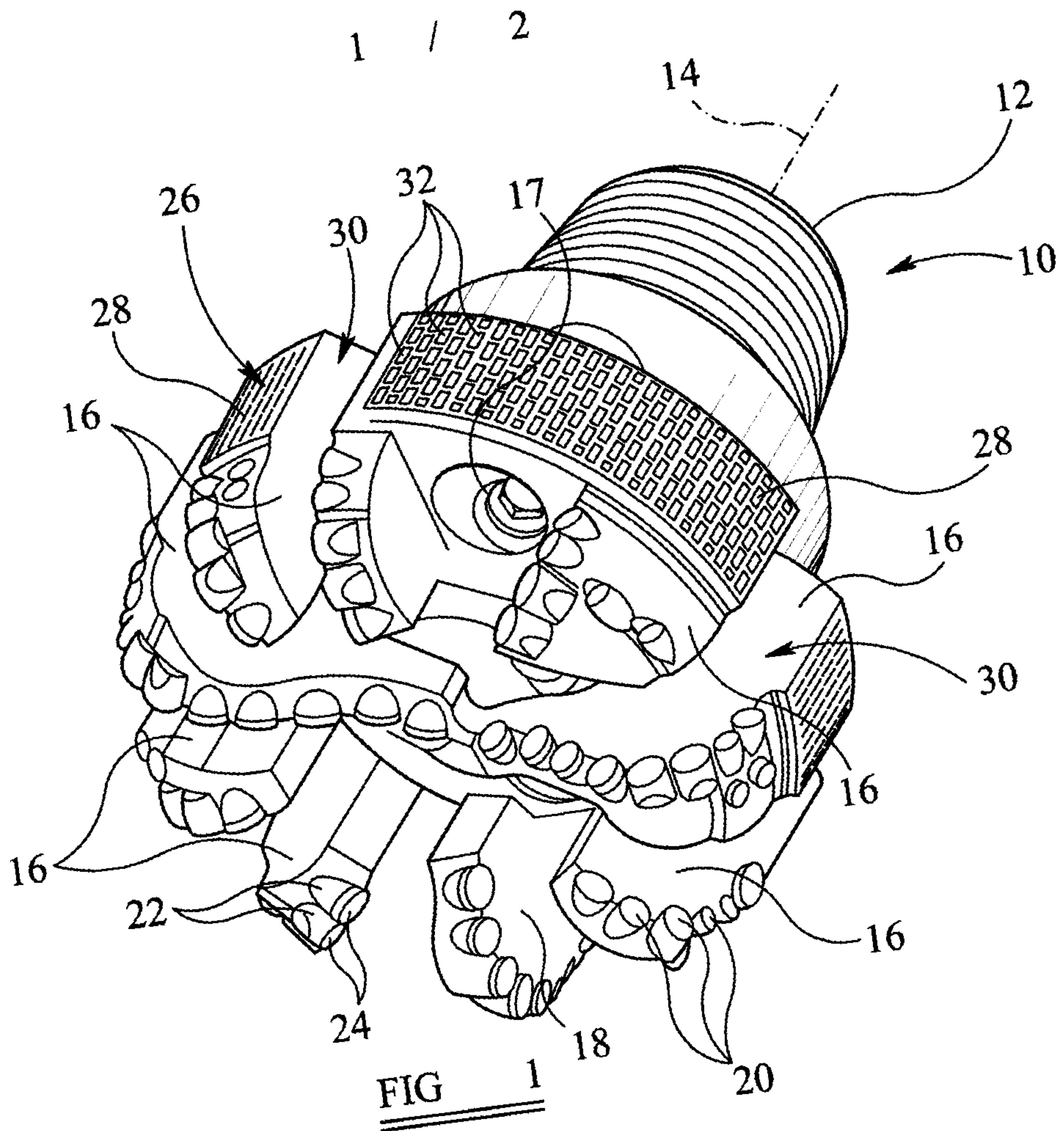
5 The elements 36 are secured to the bit body 10 by being located within locating grooves 50 formed in the gauge region 26 adjacent the leading edges of the wear reducing arrangements. The grooves 50 are of substantially part cylindrical form and serve to locate the elements 36, the elements 36 being secured in position by brazing. However, other techniques could be used to secure the elements 36 in
10 position. For example, the grooves 50 may be shaped to hold the elements 36 captive, thereby providing a mechanical lock securing the elements 36 in position. Of course, these securing techniques may be used in combination, if desired.

As described hereinbefore, the arrangement of the invention has the advantage that
15 peeling, lifting or other separation of the wear reducing arrangement is reduced, thereby reducing wear of the gauge region and extending the operating life of the drill bit.

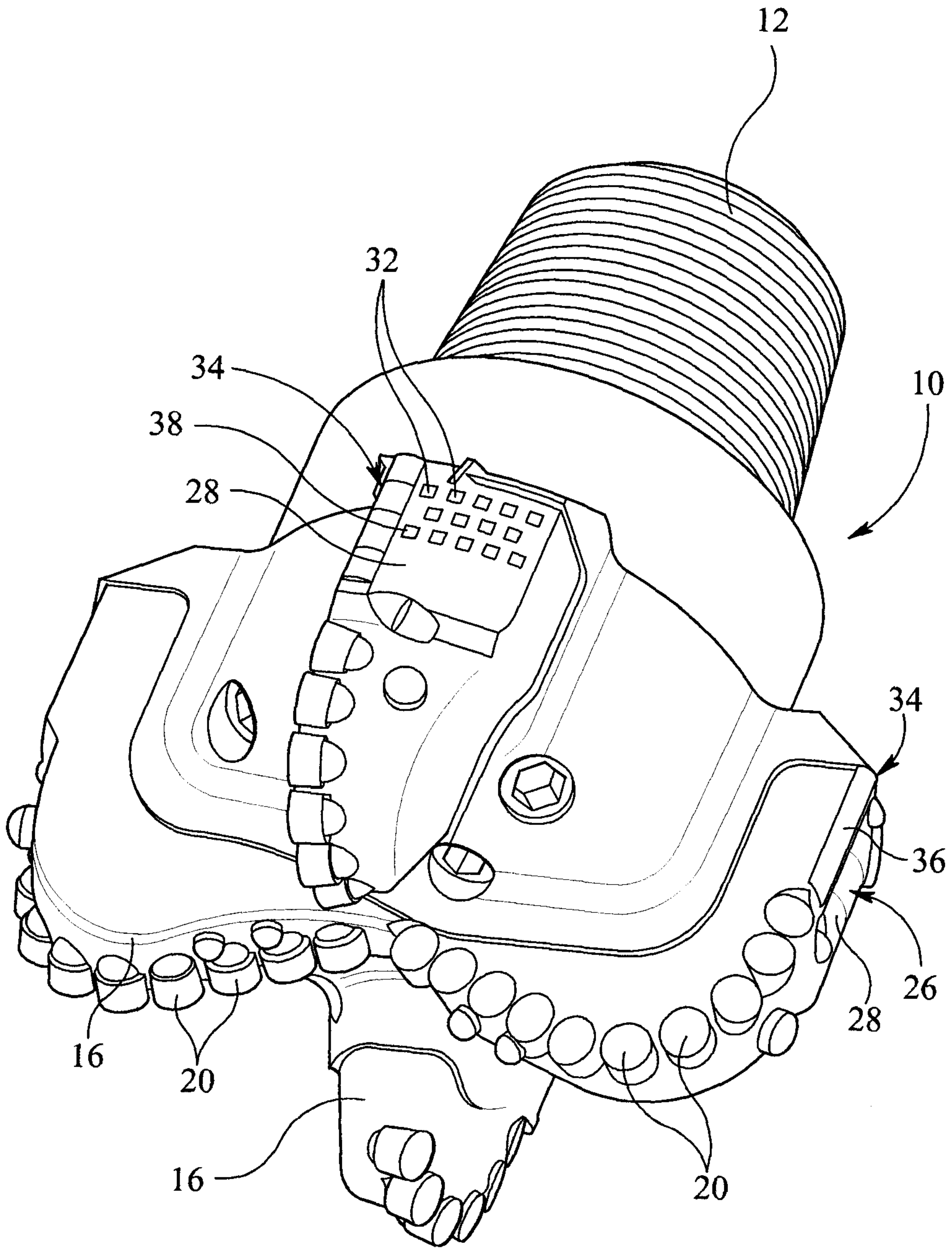
A number of modifications and alterations may be made to the arrangement
20 described hereinbefore without departing from the scope of the invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A drill bit comprising:
a bit body including a gauge region of discontinuous form, a wear reducing arrangement applied to at least part of the gauge region, and a guard arrangement protecting at least part of a leading edge of the wear reducing arrangement, the guard arrangement comprising an element of tungsten carbide secured to the gauge region, the element of tungsten carbide being of generally cylindrical form and having a longitudinal axis which extends substantially parallel to an axis of rotation of the drill bit.
2. A drill bit according to Claim 1, wherein the element is of multi-part form.
3. A drill bit according to Claim 2, wherein the element comprises a plurality of cylindrical components stacked one upon another.
4. A drill bit according to Claim 3, wherein the cylindrical components have polycrystalline diamond layers formed thereon.
5. A drill bit according to Claim 4, wherein the cylindrical components comprise used or reject cutters unsuitable for use as cutting elements on the drill bit.
6. A drill bit according to any one of Claims 1 to 5, wherein the bit body is formed with a locating groove in which the associated element is mounted.
7. A drill bit according to Claim 6, wherein the locating groove is designed such that the associated element is inserted therein from an end of the groove, and held captive by the groove.
8. A drill bit according to Claim 6 or Claim 7, wherein the element is brazed in position on the bit body.



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FIG 2

